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The Marketing of Kentucky Bluegrass and Orchard Grass Seeds

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BULLETIN NO. 247

The Marketing of Kentucky Bluegrass and Orchard Grass Seeds

By DANA G. CARD

Bluegrass seed and orchard grass seed are produced on a commercial scale in the United States only in certain regions, and Kentucky is the leading state in their production. The methods of marketing these seeds differ in some respects from those employed for most other farm products of Kentucky. Their localized production and the specialized outlets are factors in creating these differences. Bluegrass seed is not ready for use until it has been cured and carefully cleaned. Orchard grass seed usually must be cleaned before it is ready for use, also. The growers of other farm products frequently have the choice of several outlets while these seeds usually are sold to dealers in the producing areas, who have the necessary cleaning equipment. It should be borne in mind that bluegrass seed is obtained as a byproduct from bluegrass pastures and is not grown solely for seed, as is commonly true with other crops. Seed is harvested from part of the pastures only, so the supply can be increased by stripping seed from a larger area when it appears profitable to do so.

KENTUCKY BLUEGRASS SEED PRODUCTION

The Bluegrass Region of Kentucky is known the world over for its wonderful bluegrass pastures and the thorobred horses which are raised on these pastures. Bluegrass seed is produced on a commercial scale only in part of the Bluegrass Region, mainly in the counties of Bourbon, Clark, Fayette, Scott, Montgomery and Jessamine.

Since the seed is merely a byproduct of bluegrass pastures, the acreage from which seed is stript varies greatly with the season and the price of seed. The 1912 crop, the largest ever harvested, was estimated at 1,500,000 bushels of cured seed in the rough. This no doubt was due, first, to a favorable season, and second, to the fact that during 1911 cured seed in the rough sold for $1.65 to $1.75 per bushel, prices which, because they were considerably higher than those which had been received previously, encouraged the stripping of a larger acreage the next year. As a result of this enormous production, cured seed in the rough brought only $0.55 to $0.70 per bushel in 1922. In 1913 only 175,000 bushels were harvested. A large holdover from the 1912 crop affected the bluegrass seed market for the next four or five years. However, as one man expressed it, "The Great Master took a hand" and, with the exception of the crops of 1914 and 1922, all have been comparatively short crops since 1912, with prices gradually growing higher until in 1921 growers received from $2.00 to $2.50 for cured seed in the rough, the highest prices known in recent years. Cleaned seed sold in 1921 for $6.00 per bushel and for over $7.00 early in 1922. A report of the Commissioner of Agriculture of Kentucky shows the production of bluegrass seed in Kentucky from 1900-1921 and the average annual production for this period was 425,682 bushels. The crop of 1922, estimated to be over 1,000,000 bushels of seed in Kentucky and Missouri, started moving in July at prices from $1.00 to $1.25 per bushel for cured seed in the rough. These prices increased slowly until September, when dealers were offering $1.25 to $1.50 per bushel for cured seed in the rough and wholesale prices for cleaned 19-pound seed ranged from $3.15 to $3.40 per bushel.

While Central Kentucky is the largest producing district, about 200,000 bushels of bluegrass seed are harvested annually in the so-called Missouri area which includes small portions of Missouri, Iowa and Kansas. Missouri seed, as a rule, is a little heavier and is sometimes mixt with Kentucky seed to bring up the weight of the latter. Cured Missouri seed in the rough is sometimes shipt to Kentucky for cleaning.

Canadian bluegrass seed to some extent has competed with that of Kentucky bluegrass. These seeds are very similar in appearence and as the Canadian bluegrass seed usually is cheaper, it formerly was used to adulterate Kentucky bluegrass seed. Seed laws which have been enacted have largely eliminated this practis. Canadian bluegrass is more often used for hay than for pasture in sections where Kentucky bluegrass does not grow well so that it is not a direct competitor with the latter to any extent.

METHOD OF HANDLING ON THE FARM

The methods of stripping, handling and curing bluegrass seed are important from a marketing standpoint because of their influence upon the quality of the seed. As with other products, quality is an important factor in determining the price of Kentucky bluegrass seed. Altho the quality varies from year to year, an excellent crop may be practically lost by improper handling, or a comparatively poor crop may result in seed of reasonably good quality with proper care.

The stripping season for bluegrass comes late in May or early in June and often lasts only five or six days. The shortness of the stripping season makes it necessary to obtain a supply of extra labor and results in some seed being stript when green in order to prevent other seed from getting over-ripe. Many large farmers own strippers while others depend upon contractors to strip their seed for them. Yields range from 5 to 25 bushels per acre, depending upon the season, the presence of weeds in the field and the amount of stock grazed prior to stripping. An average yield per acre in Kentucky is about eight bushels.

Seed when removed from the stripper is placed in large sacks and taken to a suitable place for curing, either out-of-doors or in barns or tobacco warehouses. The seed is placed in long windrows, which should be about 18 inches high and not over that wide at the base. These windrows must be turned frequently, usually three or more times each day, to prevent the green seed from overheating. Overheating is the most common

cause of low germination, and usually occurs when green seed is left in sacks or large windrows too long. Seed left in sacks as long as three hours has been known to reach temperatures of 120° F. to 145° F. (1) For this reason seed should be removed from the sacks as quickly as possible and placed in small windrows, whether cured indoors or out. Tests have shown that a temperature of 140° F. results in a decided lowering of the ger-

Fig. 1.—Stripping Kentucky Bluegrass Seed.

mination percentage, so it is highly important to prevent overheating.

With favorable weather and proper attention, the seed becomes properly cured in two to four weeks. Freshly cured bluegrass seed has a low germinating power so that good seed may fail to germinate almost entirely when first taken from the ricks. If not stript too green it should test 65-85% germination after three or four months and if graded to 21 pound seed or heavier, it probably will germinate still higher. The seed

[1] "The Curing of Bluegrass Seeds as Affecting their Viability." Bulletin No. 198. Kentucky Agricultural Experiment Station, page 30.

loses from one-third to one-half its weight in the curing process, depending upon its maturity and the presence of weeds and other foreign matter. One of the dealers in bluegrass seed stated that the average germination of bluegrass seed has been improved in recent years by increased care in stripping and curing, but that there is still room for improvement.

Fig. 2.—Stript seed is placed in large sacks for convenience in handling.

MARKETING METHODS

Bluegrass seed has been sold by the farmer in one of three ways. First, standing in the field before stripping; second, after stripping, but before curing; third, as cured seed in the rough. When sold standing in the field it is sold as a whole or at a certain price per bushel of green seed stript. Men who buy from farmers in this way and do the stripping are usually

termed "contractors." They either strip the seed on shares, usually for 2/5 or 1/2 of the seed, leaving the farmer with his share of the green seed on his hands, which he sells to dealers, or they purchase the seed in the field prior to stripping. Some contractors sell their seed green; others cure it before selling.

Probably the majority of farmers who harvest bluegrass seed, do it with their own equipment, then cure the seed and sell it in the rough to large dealers. Many farmers, no doubt, would locate a direct market for their seed if it were practicable to clean it sufficiently on the farm.

After the seed has been cured it is cleaned. In cleaning, the rough seed is first broken up by a beater, then dropt into a bottomless box, out of which it is taken thru a pipe by suction. This removes sticks, stones and considerable dirt which have become mixt with the seed. The seed is then passed over a cylinder which rotates inside a closely fitting wire mesh sleeve, and rubs open the seed heads, liberating the seeds. After this is accomplished it is run thru regular seed-cleaning machinery which has been adjusted to fit bluegrass seed. During this process, most of which takes place in closed, box-like compartments, the dust and chaff are removed by a current of air and caught in long canvas tubes. This material is blown into the fire-box in the boiler room and used for fuel, sometimes furnishing one-fourth to one-third of the fuel necessary for operation. When thoroly cleaned of all foreign matter which wind and sieves can remove, the seed is run over a gravity grader which removes heavy weed seeds and grades the bluegrass seed.

The weight lost in cleaning bluegrass seed varies greatly with the crop, its condition when stript and foreign material content. A crop stript when mature, properly cured and relatively free from chaff and weeds, may lose only 25% of its rough weight in cleaning, while one stript green, carrying a mixture of stems, weeds and dirt, may lose 50% or even more. The cost of cleaning this seed, other than shrinkage, is from 10 to 15 cents per bushel of rough seed.

Large dealers in Kentucky bluegrass seed, who own cleaning equipment, are located in Georgetown, Lexington, Paris and

Winchester, Kentucky. These dealers have handled practically all the bluegrass seed which has been cleaned in the state. They buy seed in all stages, as some of them own strippers, but the bulk of the seed has been purchased as cured seed in the rough. When the seed is cleaned it is sold to wholesale dealers, jobbers, retail dealers and those who specialize in lawn grass mixtures. Kentucky dealers, as agents for the Bluegrass Seed Growers' Association, cleaned and handled the 1922 crop of seed of the members of that organization.

The marketing of any product involves the performance of a series of services in getting the product from the point of production to the ultimate user. Among the marketing services rendered by the dealers in bluegrass seed are cleaning of the seed, its storage until there is demand for it and the locating of outlets for it. Careful cleaning is of utmost importance. Storage for considerable periods is necessary. Seed to be used in the preparation of lawn grass mixtures usually is sold in the fall, but seed for golf links and pastures often must be stored until spring. The development of outlets is of importance in finding a satisfactory market for the seed.

OUTLETS FOR SEED

As has been noted above, the principal uses of Kentucky bluegrass are for lawns, golf links and pastures. The export demand at present is of much less importance than prior to the war but is again making itself felt. No doubt foreign demand will develop with readjustment of rates of exchange and European conditions.

Lawn grass mixtures in use all over the United States contain varying amounts of Kentucky bluegrass seed depending upon the price at which it is sold and upon the price of bluegrass seed in comparison with other grass seeds. This use of the seed no doubt could be increased thru advertising. The golf links in this country, which have been increasing in number so rapidly during the last few years, are taking large quantities of bluegrass seed. These links often are reseeded heavily several

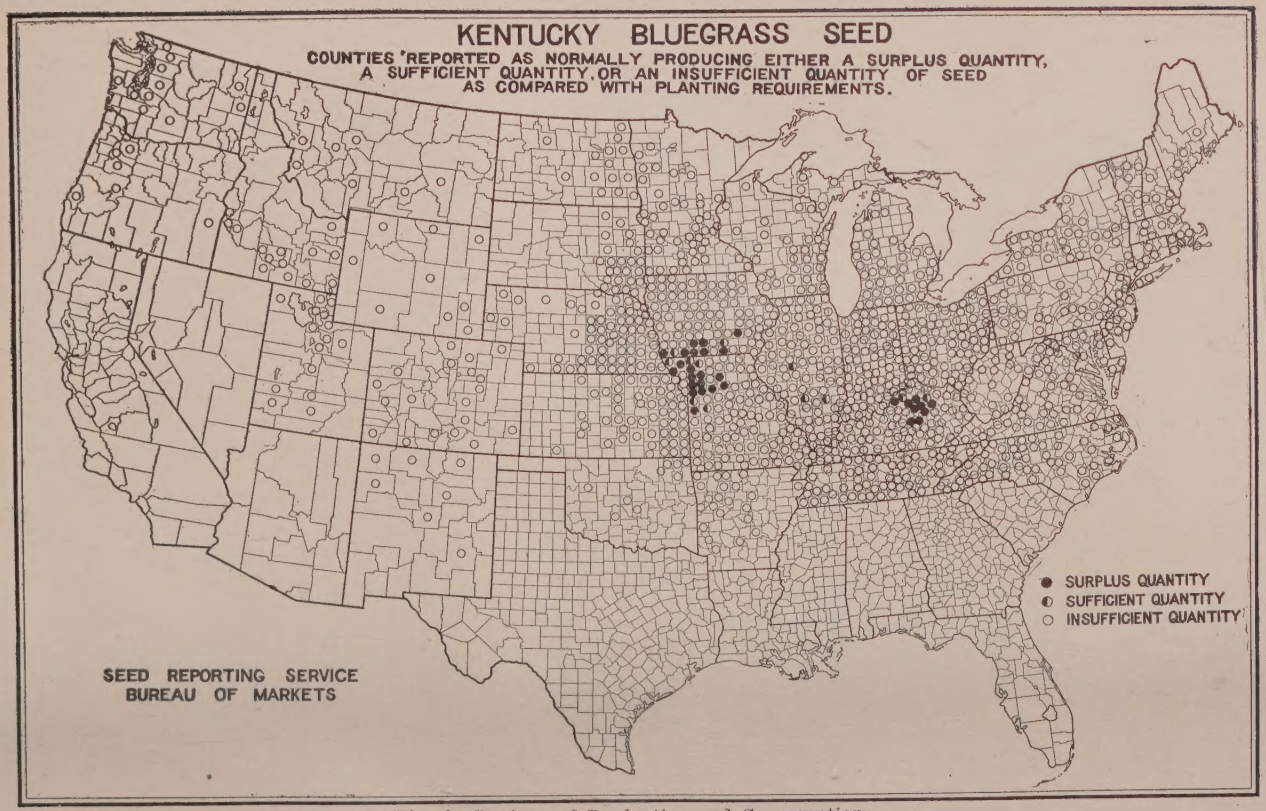
KENTUCKY BLUEGRASS SEED
COUNTIES REPORTED AS NORMALLY PRODUCING EITHER A SURPLUS QUANTITY, A SUFFICIENT QUANTITY OR AN INSUFFICIENT QUANTITY OF SEED AS COMPARED WITH PLANTING REQUIREMENTS.
SURPLUS QUANTITY
SUFFICIENT QUANTITY
INSUFFICIENT QUANTITY
SEED REPORTING SERVICE
BUREAU OF MARKETS

Fig. 6.—Regions of Production and Consumption.
(From June 7, 1919, issue of the U. S. D. A., Seed Reporter.)

times a year. Altho Kentucky bluegrass thrives much better on limestone soils, rich in phosphorus, it can be used successfuly for lawns and golf links in all parts of the country.

The amount of bluegrass seed used for pastures is comparatively small except in parts of Virginia where export cattle are finished and in Kentucky where some reseeding is required to replace pastures plowed up for tobacco.

GRADES AND GERMINATION

Altho the legal weight of bluegrass seed is 14 pounds per bushel, cleaned seed usually found in the trade weighs from 19 to 21 pounds to the measured bushel. The legal weight was established years ago when there were no adequate machines for removing chaff, immature seeds, weed seeds and the like. However the old weight still prevails, and all bluegrass seed, whether cleaned or in the rough, is bought and sold on a 14 pound bushel basis.

Bluegrass seed is seldom graded in the rough altho prices vary somewhat with the amount of foreign material mixt with the seed. The grading of cleaned seed is done by an automatic gravity grader. The grades in use which have been developt on the basis of weights are 15-, 17-, 19- and 21-pound seed. The germination usually varies with the weight and ranges from 50% to 85% or higher. Foreign trade demands a heavy seed so 23 or 24 pound seed sometimes is produced for exportation.

POSSIBLE IMPROVEMENTS

Improvements in the industry must be either in methods of production or methods of marketing and distribution. One of the weaknesses is the low germination of seed. Germination is materially affected by the condition of the seed when stript, the methods of handling while in the curing process, and by cleaning. Altho extra labor and equipment may be necessary, it is important that the seed be stript in the proper stage if high germinating seed is to be produced. The new strippers now coming into common use are helping to relieve the situation.

These strippers are much more expensive than the old comb strippers, but are labor-saving because only one man is required to operate them. Because of their initial cost they likely will not replace the old comb strippers entirely for some time. More strippers and more labor, together with greater efficiency in handling the seed, are needed to solve the stripping problem. In improving the methods of marketing bluegrass seed, as with other products, the question of quality is of major importance. Both the farmer and the cleaner are responsible for the quality of the seed because the farmer must first produce mature, well-cured seed and the cleaner must remove the light-weight seeds and foreign matter. Since over-heating is a common cause of low quality in blue grass seed, improvement may be brought about by greater care in the curing. Green seed should not be allowed to remain in sacks for more than one or two hours and should be cured in small ricks not over eighteen inches in height. Thermometers may be used to advantage in guarding against overheating. Best results in the cleaning of seed cannot be obtained unless the machines and the gravity grader used in the cleaning process are properly adjusted.

The question of increasing the demand for Kentucky bluegrass seed is important in considering ways of improving the industry. Since the grass is not suitable for hay, any increased use must be for lawns, parks, golf links or pastures. Thru advertising, satisfactory lawn grass mixtures containing bluegrass seed could be suggested, together with directions for properly preparing the seed bed and caring for bluegrass lawns. Efficient and practical methods of seeding and caring for parks and golf links could be suggested for the purpose of increasing the use of seed. A campaign leading to the beautifying of home grounds and of those around public buildings should stimulate the use of Kentucky bluegrass seed.

A careful study of the uses made of bluegrass seed should prove valuable in seeking outlets. Its use no doubt is very limited in some sections. Conditions in the bluegrass seed trade have been such that wide fluctuations in price often have occurred during the season. Such uncertainties in the market tend

to discourage rather than encourage consumption. Improvement should result from a more uniform price thruout the season and a well directed marketing organization should be able to be of service in bringing this about.

COOPERATIVE MARKETING

The Kentucky bluegrass seed industry lends itself favorably to cooperative marketing because the seed is produced in comparatively limited areas in Kentucky and Missouri, which simplifies the formation and operation of an organization. The seed meets with very little outside competition and its use very probably could be increased thru advertising. Encouraged by the widespread interest in cooperative marketing and the success of the Burley Tobacco Growers' Cooperative Association, in its first year's business, the bluegrass seed growers organized a cooperative marketing association under the Bingham Cooperative Marketing Act early in 1922. Contracts covering the delivery of about 500,000 bushels of the 1922 crop of seed were signed by producers. The Association, thru its executive committee, made contracts with Kentucky dealers to clean and sell the seed and agreed to pay them fifteen cents per bushel of rough cured seed for cleaning and ten cents per bushel of clean seed for selling. The seed was graded upon delivery and after sales are made, each member is to be paid according to the grade and quality of his seed.

The 1922 crop being unusually large, much of the normal demand for bluegrass seed was supplied by producers in the Missouri area and non-members in Kentucky who seemed willing to sell at prices slightly lower than those at which association seed was offered. In February, 1923, however, the association made a distribution to its members of about $250,000.00, equivalent to fifty cents per bushel of seed handled.

Early in March, following the first payment for seed, a meeting of the association was held and a committee was selected to work out plans for increasing the membership. A five-year contract was to be used and signatures secured, representing

three-fourths or more of the bluegrass seed production in Kentucky. Action was so delayed, however, that the 1923 crop was not handled by the association.

If future developments indicate that it will be desirable for the association to own cleaning equipment and establish its own marketing outlets, the necessary steps can be taken at such time. It would be inadvisable for the association to duplicate existing cleaning facilities or to acquire ownership of them unless a saving would result from such action. Careful consideration no doubt will be given to this matter before such a move is made.

It is still too early to know what part cooperative marketing will play in the future of the bluegrass seed industry. However, there can be little doubt of the beneficial effect of an association which is based on business principles, efficiently operated, backed by loyal support of its members and insured a sufficient volume of business by contracts with a large proportion of the growers.

No marketing organization of bluegrass seed producers has been formed in the Missouri area. This area covers a larger territory than the seed-producing region of Kentucky, since the growers who strip seed are more scattered. The possibilities of organizing the farmers in the Missouri region into an association which might be federated with an association in Kentucky are lessened by the scattered production.

The opportunities for service, open to a Kentucky Bluegrass Seed Growers' Association, are of interest in this discussion. Thru such an organization it may be possible to increase the use of bluegrass seed for lawns, golf links and parks by working with reputable lawn grass seed dealers. The good will of the trade is a valuable asset to any marketing organization. Thru efforts to stabilize the market, dealing in products of uniformly good quality and following fair business practises, this good will may be won. By carrying on educational activities among the members a bluegrass seed association should be able to improve materially the quality of their seed. No one factor will tend to increase consumption more or be of greater benefit to the associa-

tion than that of high quality seed. Members should be taught better methods of stripping, curing, handling and delivering the seed.

By the pooling of sales thru an association, growers will receive the average price paid for seed throughout the season or period during which the association is making sales. This will be of benefit in such times as the 1921-22 season when the market price of Kentucky bluegrass seed advanced about seventy-five per cent between September and January. Most of this rise in price occurred after the seed had left the growers' hands.

The individual farmer has not been able to familiarize himself with all market conditions and become an expert salesman for his products. Thru cooperative marketing, however, the bluegrass seed producer may employ expert salesmanship at a small cost per bushel because of the volume of business transacted. The association can not hope to control the production of seed because that depends upon weather conditions and the acreage stript. Neither can it fix an arbitrary price upon the seed, as price determination must be based upon careful consideration of the supply available and the demand for seed. Its possibilities, therefore, lie in improvements in handling methods, economies in marketing and the stimulation of demand. With careful study by those familiar with the trade and general economic conditions, the prices at which seed is offered by an association may be so adjusted as to strike a balance between the supply of seed available and the demand which may be developt for it. If these factors are adjusted properly the price will be as high as can be safely secured without curtailing the demand for seed. In other words, the price received will be what the market justifies.

The opportunities in advertising have been discust. Activities in this field will become possible thru cooperative marketing when a sufficient volume of business is handled to warrant the required expenditure of funds. Such advertising should seek to extend the distribution and use of bluegrass seed to sections where it is not used at present and also to increase its use in regions now partially supplied.

The opportunities open to a cooperative marketing association, however, do not insure its success. These opportunities must be taken advantage of. First of all, the association must be of service to its members and to those with whom it has dealings. It must lessen marketing costs or perform the marketing services more effectively than they have previously been performed. To do this a volume of business sufficient for economical operation must be obtained. Sufficient capital for the needs of the organization must be available. There are numerous ways of securing needed capital, such as from banks, individual investors, the membership and from the sale of goods. Many associations are entirely financed by means of membership fees or subscription to capital stock made by members. Products in storage furnish security for obtaining loans for use in making advances to the members and paying operating expenses.

No business organization can accomplish much without good management. The business manager and officers of the bluegrass seed association should be selected because of their knowledge of the business to be undertaken, their unquestioned honesty and integrity and the faith and confidence which association members have in them. Inefficient management is one of the leading causes of failure in cooperative marketing associations and should be carefully guarded against.

The members must be loyal to their organization if it is to be of outstanding success. Membership loyalty implies the production of high quality products and marketing them thru association channels. It implies active participation in the affairs of the association insofar as the individual member is concerned. Members should feel their responsibility in selecting officers and directors of the association. Their relationships with non-members should always be friendly. They should attempt to secure additional members for their organization thru careful persuasion, but always bearing in mind that it is everyone's privilege to remain a non-member if he so desires.

With these essentials for successful operation carefully secured and maintained, a bluegrass seed growers' association should become an influential factor in the industry and be of material benefit to the producers. If a successful organization is formed in the Missouri area this benefit may become even greater thru the federation of the two organizations.

AVERAGE WHOLESALE PRICES OF KENTUCKY BLUEGRASS SEED IN THE UNITED STATES*

	Corresponding Dates in				
	1923	1922	1921	1920	1919
	Per 100 lbs.	Per 100 lbs.	Per 100 lbs.	Per 100 lbs.	Per 100 lbs.
January	$26.25	$48.05	$27.90	$29.05	$22.25
	26.45	48.35	28.05	29.30	23.00
	26.40	48.25	27.75	29.50	22.25
	26.40	48.25	27.65	29.70	22.75
February	26.30	48.85	27.35	29.90	23.00
	26.35	49.30	27.50	30.10	23.00
	26.20	50.20	27.30	30.20	23.00
	26.10	50.40	27.25	30.30	23.00
March	26.05	51.40	27.15	30.45	23.00
	25.90	51.90	27.15	30.55	23.00
	25.25	52.05	27.65	30.40	23.00
	25.75	52.40	28.50	30.30	23.00
April	25.60	52.55	29.30	30.05	24.00
	25.40	53.20	30.90	29.65	24.75
	25.55	54.00	31.65	29.35	24.75
	25.40	55.80	31.90	29.25	24.75
	25.40	55.90	32.25	29.10	24.75
May	25.10	56.00	32.40	28.90	24.75
	24.65	56.20	32.90	28.30	24.75
	24.30	56.20	33.05	28.25	24.75
	24.30	56.35	33.95	28.25	24.75

*Wholesale prices of field seeds, on Saturday, in twelve leading markets are quoted in Weather, Crops and Markets each week. These prices are used to compute the United States average from which the above table has been compiled.

PRODUCTION AND PRICES OF KENTUCKY BLUEGRASS SEED IN KENTUCKY

Data for the years 1900 to 1918, inclusive, have been taken from a table in the July 12, 1919, issue of the Seed Reporter. Data for the years 1919 to 1922, inclusive, have been compiled from issues of Weather, Crops and Markets and the Seed Reporter.

Year	Production of Stripped Seed, Bus.	Prices Paid Growers for Stripped Seed, Per Bu.	Cleaners' Selling Prices in Carload Lots Per Bushel	
1900	500,000	$0.42—$0.45	$0.85—$1.00	for 19-lb. seed
1901	400,000	.50	.80— 0.85	
1902	275,000	.72	1.10— 1.15	
1903	340,000	.65	1.18— 1.20	
1904	750,000	.42— .45	.65— .85	
1905	275,000	.70— .85	1.25— 1.30	
1906	350,000	.70— .85	1.65— 1.85	
1907	425,000	.80— 1.25	2.00— 2.25	
1908	600,000	.60— .62½	1.13½	for 21-lb. seed
1909	450,000	.80— 1.00	1.68— 1.82	
1910	200,000	1.25— 1.60	2.65— 2.90	
1911	350,000	1.65— 1.75	2.35— 3.20	for 19-lb. seed
1912	1,500,000	.55— .70	.95— 1.15	
1913	175,000	.60	.90	for 21-lb. seed
1914	700,000	.45	.90	
1915	350,000	.60	1.50	
1916	250,000	.70	1.25	
1917	200,000	1.40— 1.65	2.75	
1918	350,000	1.50	2.85	
1919	375,000	1.50— 1.75	3.55— 4.25	for 19-lb. seed
1920	325,000	1.75— 1.85	3.65— 4.25	
1921	175,000	2.15— 2.25	6.60— 8.10	
1922	700,000	1.25— 1.50	3.50	

ORCHARD GRASS

Orchard Grass Seed Production

The principal orchard grass seed producing area in the United States is located near Louisville, Kentucky, including the counties of Oldham, Shelby, Henry, Woodford, Franklin and Jefferson, in Kentucky, and Clark, Jefferson and Switzerland, in Indiana. Warren and Barren counties in South Central Kentucky, and Clinton and Highland counties, in Ohio, are other

Fig. 4.—Harvesting Orchard Grass for Seed.

smaller producing areas. Fauquier county, Virginia, produces about 30,000 bushels of orchard grass seed annually. Missouri has come into the field recently and produces about 50,000 bushels annually. The Kentucky, Indiana and Ohio areas produce about 225,000 bushels in a normal season, a large portion of which passes thru the hands of Louisville and Cincinnati dealers.

Orchard grass seed produced in this country must compete in the market with imported seed. Importations of orchard grass seed in some years have amounted to over 200,000 bushels. In Denmark, a large producer of orchard grass seed, the grass is

planted in rows and cultivated. This practis, together with seed selection and the use of commercial fertilizers, has developt yields of 25 to 40 bushels, whereas yields in Kentucky average 10 to 15 bushels per acre. In New Zealand the seed grows wild among the forest trees and is harvested by hand. Foreign seed usually is brighter in color and somewhat heavier in weight than home grown seed.

Orchard grass seed prices were good, during and after the World War period, until 1922. Much of the 1921 crop was pur-

Fig. 5.—Orchard grass is allowed to cure in the field before threshing.

chased from farmers at $2.00 per bushel on the basis of recleaned seed, while the wholesale price for the same period was about $2.50 per bushel. In 1922 growers received from $0.75 to $1.25 for machine run and $1.00 to $1.50 per bushel for seed purchased on the recleaned basis, while prevailing wholesale prices were $1.65 to $1.95 per bushel for recleaned seed.

Methods of Handling on the Farm

Orchard grass is cut with a binder and tied in very small bundles to facilitate curing. Three bundles are placed together in a shock and tied with two bands near the top. Harvesting in

the Kentucky-Indiana area usually begins about the middle of June and lasts a week or ten days. The shocks are allowed to stand from two to four weeks or until properly cured, when they are threshed directly from the field. The small shocks are loaded on wagons, drawn to the thresher and placed on the table before the bands are broken, reducing loss from shattering to a minimum. A common grain separator, with special riddles, is used for threshing orchard grass. Usually the seed is placed in large eight-bushel sacks for convenient handling.

The threshing of orchard grass seed requires careful attention, since the seed is so light there is great danger of blowing it over. The wind must be carefully controlled to blow out red-top seed and chaff but retain the slightly heavier orchard grass seed. Threshing so as to avoid unnecessary loss of seed is a problem of considerable importance to the grower.

Marketing Methods

The marketing of orchard grass seed after it leaves the farm has been left entirely to dealers. These dealers usually are engaged in handling other field seeds also. This affords the use of cleaning equipment, warehouse space, office supplies and labor in handling orchard grass seed, when needed, which can be used for other products during the remainder of the year.

The recleaning of orchard grass seed is an important service performed by dealers. Altho the process required is not as elaborate as in the cleaning of bluegrass seed, it requires accurately adjusted machinery and careful attention. The equipment used in recleaning the seed is a common seed-cleaning mill, using sieves and wind to remove foreign matter. Foreign material, weed seeds, light-weight orchard grass seed and other seeds, if not removed, lower the quality and sale value of the orchard grass seed. According to estimates made by dealers the cost of recleaning orchard grass seed varies from five to ten cents per bushel, with an average of about nine cents per bushel of recleaned seed. The additional expense due to loss in weight from the removal of weed seeds, chaff, light seeds and the like, varies

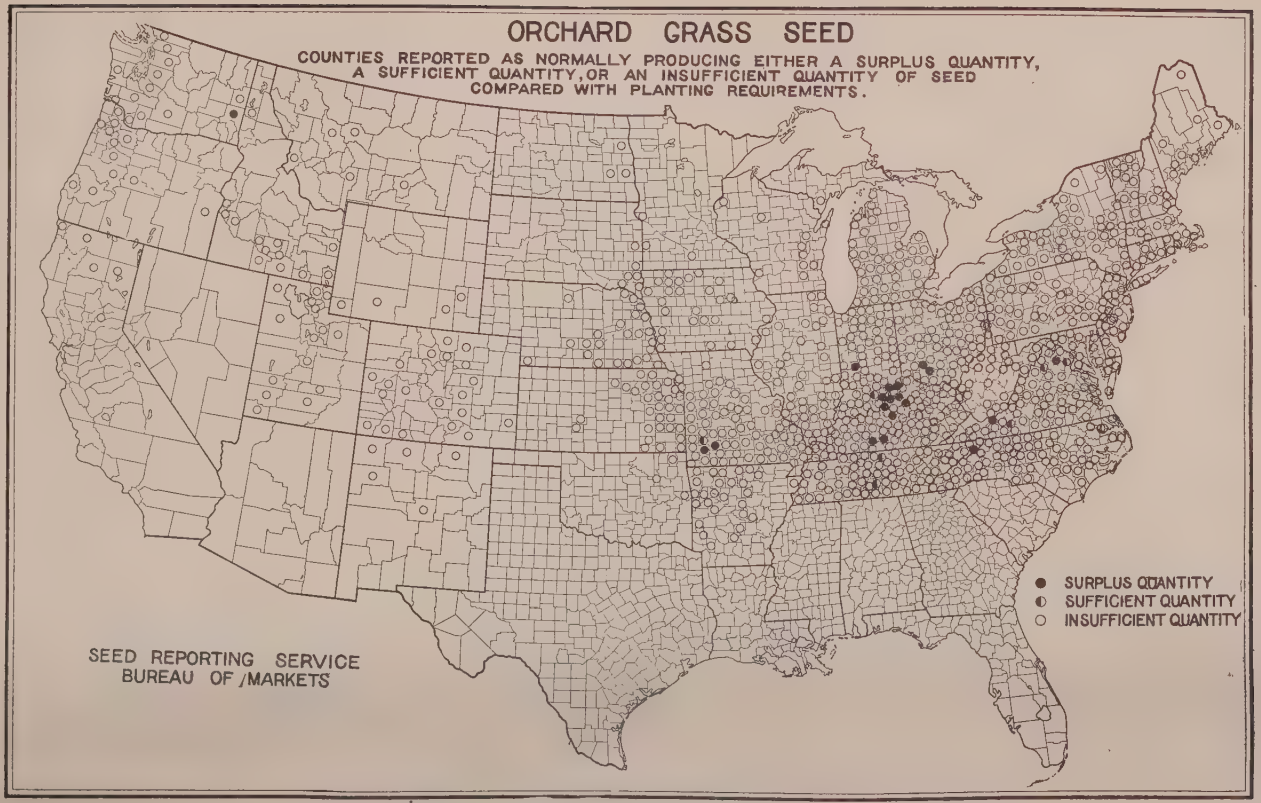
ORCHARD GRASS SEED
COUNTIES REPORTED AS NORMALLY PRODUCING EITHER A SURPLUS QUANTITY, A SUFFICIENT QUANTITY, OR AN INSUFFICIENT QUANTITY OF SEED COMPARED WITH PLANTING REQUIREMENTS.
SURPLUS QUANTITY
SUFFICIENT QUANTITY
INSUFFICIENT QUANTITY
SEED REPORTING SERVICE
BUREAU OF MARKETS

Fig. 3.—Regions of production and consumption.
(From June 7, 1919, issue of the U. S. D. A., Seed Reporter.)

considerably with the quality and price of seed. Sometimes the seed is sufficiently clean for market when it comes from the thresher.

Much of the seed is purchased from the farmers by wholesale dealers thru field representatives who visit each farm and make a preliminary test of the seed by means of a small cleaning machine operated by hand. The approximate amount of recleaned seed which can be obtained from each crop is calculated from the test and the price offered is based upon this amount. The prices usually include delivery to the grower's shipping point from which the dealer pays further transportation charges.

Some seed is sold by the wholesale dealers in the summer and fall, but the height of trade comes in the early spring, which necessitates storage thru the winter. The seed loses little weight if properly stored in a dry warehouse. The furnishing of such storage and the funds required to hold the seed as well as carrying the risk of loss from market fluctuation, fire and other causes are additional costs to the wholesale dealer.

Altho the commercial production of orchard grass seed in the United States is limited to comparatively small areas, the grass is used for hay and pastures in many parts of the country. The dealers who reclean the seed, sell to wholesale dealers, jobbers and retailers in other markets. Sometimes seed has been exported during years of a short foreign crop.

Outlets for Seed

Orchard grass is in little demand as a hay crop in sections where timothy yields well, because of its coarse and woody texture, especially if allowed to ripen before cutting. When cut in the bloom and well cured, however, it makes excellent hay for cattle and horses. The quality of orchard grass hay may be much improved by sowing with it red or alsike clover. The orchard grass and clover are ready to cut at about the same time and often yield a second crop in favorable seasons. This mixture is not so desirable when grass is grown for seed altho the clover often dies out after the first or second year leaving a clean field of orchard grass.

Orchard grass has proved to be excellent for pastures, especially when mixt with clover and other grasses. It is being recommended in mixtures for the renewal of old pastures because of its luxuriant growth both early and late in the season. More orchard grass would be used for pastures if farmers realized its full value. By planning the farm operations so that the grass could be cut somewhat earlier than the usual haying season, orchard grass might well be used more extensively for hay.

Aside from its use for hay and pasture in practically all sections of the country, orchard grass is used to some extent for an orchard mulch.

Grades

Altho orchard grass seed varies somewhat in weight, all sales are made on the basis of 14 pounds per bushel. Sales are made by sample because no definite grades have been established and variation in the color, purity and germination of the seed makes it difficult to sell by description. Heavy paper envelopes bearing the results of germination and purity tests are used to distribute samples by mail to prospective purchasers.

Because there are no definite grades for orchard grass seed, it usually is classified on the basis of germination, which varies from 60% to 90%. Imported seeds are classified according to the percentage of pure viable seed, which considers both the purity and germination of the seed. Thus seed testing 90% purity and 90% germination rates as 81% viability. All imported orchard grass seed must show a viability test of 65% or more.

Possible Improvements in the Present System

One improvement needed is the production of cleaner seed. Weed seeds, chaff and the like, in seed, make threshing and recleaning more expensive. Since some weed seeds are very difficult to separate from orchard grass seed, the production of clean seed should start in the field. Clean seed should be used in sowing a properly prepared seed bed and weeds should be kept down in the fields insofar as possible. This is done quite satisfactorily

by the use of sheep which can be grazed in orchard grass fields up to within two or three weeks of harvesting. They eat down weeds and tender grass blades in preference to the more woody seed stalks, and so do not injure the seed crop materially. This practis of pasturing sheep in orchard grass fields is quite common in the seed-producing areas but can well be extended. Some hand work in cutting out dock and other weeds is of benefit.

The importance of clean seed is stressed in the following statement made under "Observations of the European Seed Trade" in the Seed Reporter for April 5, 1919:

"**Orchard Grass, or Cocksfoot.** In the past the larger part of the imports of orchard grass into the United Kingdom have been from the United States and New Zealand. In recent years, Denmark has been offering considerable seed which, because of its better average appearance and purity, has taken precedence over some of the American seed. From a casual examination of a number of samples, it appears that the advantages of the Danish seed are entirely in appearance and purity. In both weight and germination it seems that the American seed averages fully as good as, or better than, the Danish seed. If greater care is taken by American exporters in the preparation of orchard grass seed for export, to remove the dock, sorrel, and other impurities that are often present, and by American growers to give more attention to keeping the weed seeds out of the crop, it is thought that the American seed will regain its former position with British dealers and that there will even be an increase over the former normal demand. Where British dealers find it necessary to reclean cocksfoot (orchard grass) in order to meet their trade requirements, there is a great expense, due to (1) cost of recleaning, (2) reduction in weight caused by removing weed seeds and hulled cocksfoot, and (3) freight paid on useless foreign matter which is removed in cleaning."

Another improvement can be made in the care taken in threshing, both from the standpoint of producing clean seed and of eliminating waste. Stacks of orchard grass straw sometimes include enough seed blown over in threshing to make a fairly good profit on the crop, had it been saved. Proper adjustment of both screens and fans is important in threshing orchard grass.

Foreign grown seed can compete successfully with home grown seed, partly because of higher yields of seed in producing

regions. Little work has been done in this country toward improving strains or yields of orchard grass. In increasing the yield of orchard grass seed by selection, great care must be taken that the hay and pasture qualities are not lost as the yield of seed increases. Fertilizer tests also might prove of value in pointing the way to increased yields.

If orchard grass is to become more widely distributed, this must be brought about mainly thru increasing its use as a pasture grass. Experimental work has shown that orchard grass is very valuable in seed mixtures for pastures. Some state agricultural colleges are recommending its use in pasture improvement work. This information might well be employed to increase the use of orchard grass seed, thru advertising. No individual farmer or dealer who handles a small amount of seed can afford to advertise very extensively altho a farmers' cooperative association handling more seed might be able to do so. Orchard grass is used to some extent as an orchard mulch. "Sod culture" is becoming a more common practis in some apple sections and as this grows it may furnish a slight demand for orchard grass seed.

COOPERATIVE MARKETING

A discussion of cooperative marketing of orchard grass seed may be divided into, first, what has been done in the past, and second, what may be done in the future. Several years ago the orchard grass seed producers formed an association and made arrangements with a firm in Louisville to handle their seed. The seed was graded, recleaned and sold for a definite charge per bushel by this firm and settlement was made with the members after the seed was sold. Altho this system worked satisfactorily for some time, there was a gradual decrease in the membership. Competing firms in Louisville made good offers to members of the organization as well as to non-members. No contracts to deliver their seed to the association were signed by members and when prices continually improved during the war period the orchard grass seed growers' association became inactive.

There also have been local pools for the sale of machine run seed to dealers. One successful pool of this kind was centered at Eminence, Kentucky, in 1920. A competent man was selected to

sample and grade each man's crop on his farm. These samples were assembled and classified and each crop graded according to this classification. A record was kept of the amount of seed in each classification and this information was used in securing bids. This method, tho quite satisfactory, was temporary, since no permanent organization which could be depended upon to perform this service from year to year was formed. The expense of selling seed thru this pool was about one-half cent per bushel and the net price received was as high as that at which the bulk of sales were made that season, or higher. This pool is of interest because it demonstrated the possibility of grading machine run orchard grass seed as a basis of sale. Such a plan would be of considerable advantage to a cooperative association organized for the marketing of orchard grass seed as each grower could be paid in accordance with the quality of his seed.

There are possibilities for future development in the cooperative marketing of Kentucky and Indiana orchard grass seed. Some of the conditions which favor this development are the comparatively small area of production, the ease with which the seed may be handled, the possibility of meeting the competition of foreign seed thru an organization, and the opportunity for increasing the use of orchard grass thru advertising.

Altho up to the present time no official experiments have been completed comparing home grown and foreign seeds it is commonly believed that home grown seed is preferable for seed, hay and pasture uses. Foreign seed usually is brighter in color and more attractive in appearance and this probably accounts for its extensive use. Official experiments comparing foreign and home grown seed might be of considerable value.

During the spring of 1922, the farmers of Oldham county, Kentucky, undertook to form a cooperative marketing organization. Articles of incorporation and bylaws were drawn up and contracts printed. Nearly all the orchard grass seed producers in Oldham and Jefferson counties signed the contracts, but sufficient signatures in other producing counties were not obtained to make the contract binding, as it called for a sign-up of seventy-five per cent of the production in Kentucky. In the spring

of 1923, renewed interest in cooperative marketing resulted in further consideration being given to organization plans.

If a cooperative marketing association for orchard grass seed is formed, it should be organized, like other farmers' cooperative marketing associations, for a definite purpose, operated on business principles, properly financed and efficiently managed. Such an association might sell the seed of its members to wholesale dealers, the dealers might be employed as agents to clean and sell the seed or, if it seemed advisable, the association might purchase and operate cleaning equipment and sell the recleaned seed to wholesale seed men or jobbers. Such a movement, coming from the producers in an effort to help themselves, if properly managed, should be of material benefit to the orchard grass seed industry.

As in the case of Kentucky bluegrass seed the opportunities in cooperative marketing are not those of price fixing or control of production, but are primarily those of economical marketing and improvement of demand for the seed. Numerous examples of beneficial results from advertising by cooperative marketing associations may be found. Among the most outstanding are the "Sunkist" oranges of the California Fruit Growers' Exchange and the "Eatmor" cranberries of the American Cranberry Exchange. The production of oranges has steadily increased but the development of demand thru advertising backed by a high quality product and an efficient system of distribution has furnished a ready outlet for them. Advertising as a means of increasing the use of cranberries was first carried on in one of the larger markets. This resulted in an increased consumption, over that of the previous three years, of about 44 per cent, while the consumption in six other leading markets decreased materially during the same season. The first attempt being successful, advertising has become an important part of the services performed by the American Cranberry Exchange.

Those interested in marketing orchard grass seed cooperatively may well look to the opportunities in advertising. Its value as a pasture grass could be stressed and satisfactory mixtures for meadows and pastures could be suggested. Improved

cultural methods and economical uses of fertilizer might also be suggested. A study of the distribution of orchard grass seed should prove valuable by suggesting ways of increasing its use.

Quality is one of the most important factors in marketing any product successfully. Orchard grass seed growers must look to methods of producing a product of high quality economically, since they must always face the competition of imported seed and their industry can only be profitable as they are able to meet this competition successfully.

AVERAGE WHOLESALE PRICES OF ORCHARD GRASS SEED IN THE UNITED STATES*

	Corresponding Dates in				
	1923	1922	1921	1920	1919
	Per 100 lbs.	Per 100 lbs.	Per 100 lbs.	Per 100 lbs.	Per 100 lbs.
January	$14.00	$18.80	$15.90	$26.35	$27.00
	14.00	18.85	15.90	26.30	27.00
	14.00	18.90	15.70	26.35	27.00
	14.05	18.70	15.50	26.45	27.50
February	14.00	18.70	15.15	26.65	27.50
	14.00	18.70	15.10	26.65	27.50
	14.00	18.80	15.05	26.65	27.75
	13.90	18.80	14.65	26.65	27.75
March	13.95	18.80	14.75	26.40	27.75
	13.95	18.85	14.85	26.05	28.00
	13.85	18.90	15.00	26.00	28.00
	13.85	18.85	15.10	25.85	28.50
April	13.70	18.40	15.15	25.75	28.50
	13.65	18.70	15.20	25.25	28.50
	13.70	18.50	15.20	24.90	28.50
	13.75	18.40	15.25	24.65	28.50
	13.75	18.40	15.20	24.75	28.50
May	13.70	18.20	15.20	24.15	28.50
	13.70	18.10	15.10	23.95	28.50
	13.75	18.05	15.35	23.75	28.50
	13.75	17.95	15.35	23.75	28.50

*Wholesale prices of field seeds, on Saturday, in twelve leading markets, are quoted in Weather, Crops and Markets each week. These prices are used to compute the United States average from which the above table has been compiled.

ESTIMATED PRODUCTION AND PRICES PAID PRODUCERS FOR ORCHARD GRASS SEED

(Kentucky and Indiana)

Data for 1908 to 1917, inclusive, have been taken from a table in the November, 1917, issue of the Seed Reporter. Data for 1918 to 1922, inclusive, have been compiled from a number of issues of the Seed Reporter, Market Reporter and Weather, Crops and Markets. Prices for 1918 and 1919 were obtained directly from a large wholesale seed dealer.

Year	Total Production in Bushels	Average Per Bu. to Producers	
1908	250,000	$1.90	
1909	220,000	1.40	
1910	120,000	1.75	
1911	260,000	1.80	
1912	240,000	1.25	
1913	150,000	1.60	
1914	165,000	1.70	
1915	160,000	1.80	
1916	200,000	2.00	
1917	175,000	2.20	
		Prices paid producers on basis of country run seed—recleaned seed.	
1918	250,000	$1.85—$2.50	
1919	214,000	1.80— 2.75	
1920	200,000	1.25— 1.75	$1.40—$2.25
1921	125,000	1.50— 1.75	2.00
1922	200,000	.75— 1.25	1.00— 1.50

IMPORTS OF ORCHARD GRASS SEED

(From U. S. D. A. Yearbook, 1922, and Weather, Crops & Markets)

During Twelve Months Ending June 30	Pounds	Bushels
1911	548,000	39,150
1912	137,000	9,800
1913	119,000	8,500
1914	1,939,000	138,500
1915	701,000	50,700
1916	754,000	53,850
1917	1,286,000	91,850
1918	58,000	4,100
1919	177,000	12,650
1920	2,771,000	197,900
1921	----------*	----------*
1922	2,922,000	208,700
1923	768,000	54,850

*None reported.

Kentucky Agricultural Experiment Station

University of Kentucky

Studies of Dairy Cattle II. Milk Production.

1. INFLUENCE OF THE GROWING FOETUS.
2. INFLUENCE OF EARLY AND LATE ABORTIONS.
3. INFLUENCE OF ABORTION OF FIRST CALVES.
4. INFLUENCE OF SEASON.

BULLETIN NO. 248

(Research Bulletin)

Lexington, Ky.

July, 1923

(63)

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BULLETIN NO. 248

Studies of Dairy Cattle II. Milk Production.

By J. J. HOOPER

This bulletin contains studies made recently in reviewing the daily milk records kept on the Station dairy herd for the past twelve years, and official test records of the past two years.

The production, or secretion, of milk by the dairy cow has been studied from four angles, as follows:

(1) Influence of the growing foetus.
(2) Influence of early and late abortions.
(3) Influence of abortion of first calves.
(4) Influence of season.

1. Influence of the Growing Foetus on Milk Production.

For a considerable time it has been realized that a cow cannot carry a calf and equal in milk production an unbred cow.[1] Sometimes it has been the practise of dairymen to leave their test cows unbred until after they have completed their year's test, or at least not to breed the cows until late in the year of the test. To gain accurate data on this question and to compare the milk production of cows bred early in their lactations with ones bred later, we searched the records on the Experiment Station herd and found that twenty-four of the cows were bred early during one of their milking periods (about the 80th day after calving) and another year the breeding was deferred for one reason or another until about the 215th day after calving.

The year that the cows were bred on about the 80th day after calving they went 360 days between calves and milked 311

[1] Ky. Bul. 234, Part 3.

days. The year they were bred about the 215th day they went 495 days between calves and milked 431 days out of 495 days between calvings. We can thus compare the milk yield of 24 cows bred early in their milking period one year, with the yield of the same cows bred late another year. The larger foetuses in the first case seem to check the milk yield in the latter months of the lactation. A similar study has been reported by C. H. Eckles.[2]

The average production of milk per cow by these twenty-four cows was quite different during the two lactations, as shown by the table and graph that follow:

TABLE I.

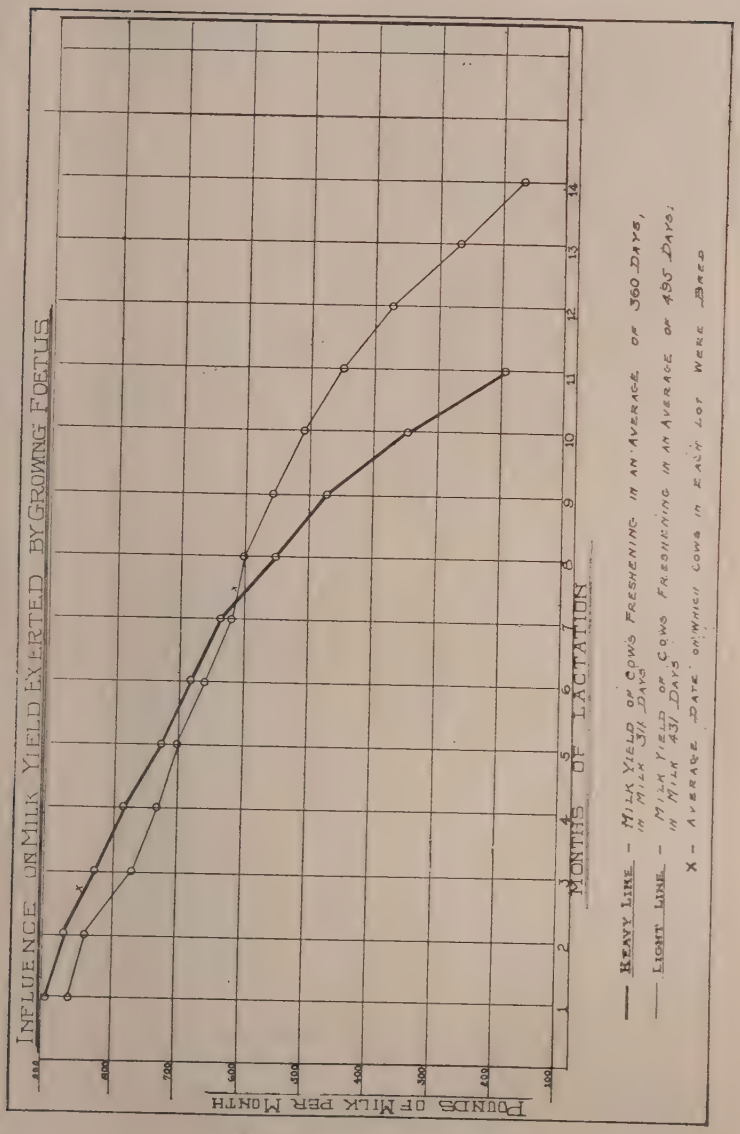
Average Production Per Cow.

	360 Days Between Calves	495 Days Between Calves
Number of cows	24	24
Days in milk	311	431
Milk yield for twelve months	6980	7693
Milk yield for the lactation	6980	8128

When the cows were bred about the 80th day after calving they produced 6980 pounds of milk in the year, dried up in 11 months and had a month's rest before next calving. When left unbred, or open 215 days, they produced 7,693 pounds of milk in the year, an excess of ten per cent over the other year; they milked 431 days and produced 8,128 pounds of milk. When left open, or unbred, for 215 days they milked for a longer period and held up better in milk yield. It seems apparent that when the foetus is about five months old it causes a perceptible shrinkage in milk production.

To explain this behavior it has in the past been thought that the production of a foetus was a great strain on a pregnant cow. A recent report from S. Brody, A. C. Ragsdale and Chas. W. Turner[2*] contains the statement that "it is inferred that growth

[2] Hoard's Dairyman, March 2, 1923.
[2*] Journal of General Physiology, Vol. V, No. 6, July 20, 1923.


INFLUENCE ON MILK YIELD EXERTED BY GROWING FOETUS
POUNDS OF MILK PER MONTH
MONTHS OF LACTATION
HEAVY LINE - MILK YIELD OF COWS FRESHENING IN AN AVERAGE OF 360 DAYS, IN MILK 311 DAYS
LIGHT LINE - MILK YIELD OF COWS FRESHENING IN AN AVERAGE OF 495 DAYS; IN MILK 437 DAYS
X - AVERAGE DATE ON WHICH COWS IN EACH LOT WERE BRED

of the fetus is in part, at least, responsible for the decline in milk flow due to the demand of the fetus for nutrients to support its life processes." But Eckles[3] has shown that "On the dry matter basis a Jersey calf at birth is only equivalent to 110 to 170 pounds of Jersey milk." The production of this much milk is not considered much of a strain on a good cow. A more correct explanation seems to be that probably the growing foetus, at about five months old, produces a material that checks the milk flow of the mother. This is fortunate for it dries her off preparatory to the duties of feeding another calf.

G. d'Errico[4] has found that when blood was taken from the veins of one lactating bitch and put into the veins of another lactating bitch there was no effect, but when blood from a pregnant bitch was transferred to one giving milk, the milk flow was checked. This suggests that the developing foetus (of the pregnant bitch) was secreting something that checks milk flow.

To secure the maximum production from the cow for 12 months, it would apparently be best to leave her open, or unbred, for about six or seven months of her lactation period. But if the purpose is to secure maximum production of milk for two years or for the life of the cow, it would be better to have her calve every 12 months, as she would start each new year with a high flow of milk from the new calving. From the above table it is found that the early bred cows produced 6,980 pounds of milk in 12 months, or averaged 581 pounds milk a month, whereas the late bred cows produced 8,128 pounds of milk in 16½ months, or averaged 492 pounds milk per month.

Shrinkage in Milk Yield Each Succeeding Month of Lactation

Several investigators have gathered data regarding the shrinkage in milk yield that occurs each succeeding month of the lactation period and one of them, Professor F. W. Woll,[5] calls attention to the fact that unbred cows do not decline as rapidly in milk flow as pregnant cows, but none of the investi-

[3] Missouri Research Bulletin 26.
[4] Exp. Station Record, Vol. 26, p. 376.
[5] Wis. Expt. Sta. Research Bul. 26.

gators gives separate estimates for bred and unbred milk cows. The estimates of these several investigators, based on studies of numerous lactations, are as follows:

TABLE II.

Shrinkage of Milk Yield Each Month Expressed as Percentage of the Yield in the Preceding Month.

Month of Lactation	Conn.[6]	Wis.[7]	Wis.[8]	Mo.[9]	Maine[10]	Average
Second	7.9	5.0	6.4	+3.0	7.0	4.7
Third	8.5	7.0	7.2	5.8	7.5	7.2
Fourth	5.7	6.0	7.9	7.2	8.1	7.0
Fifth	4.5	5.0	5.2	6.7	8.9	6.1
Sixth	5.6	5.0	3.5	6.0	8.3	5.7
Seventh	6.1	6.0	6.5	5.0	10.6	6.8
Eighth	7.5	10.0	10.2	5.4	10.2	8.7
Ninth	14.2	13.0	10.9	5.6	13.2	11.4
Tenth	13.3	20.0	17.4	6.0	15.2	14.4
Eleventh	.....	13.0	7.1	6.3	2.5	7.2
Twelfth	.....	16.0	5.7	8.5	0.	10.1

[6] Conn. Sta. Bul. 29.
[7] Wis. Research Bul. 26.
[8] Wis. Bulletin 102.
[9] Ragsdale and Turner, Jersey Bulletin, April 18, 1923. Recalculated on month-to-month basis.
[10] Report of Progress in Animal Husbandry Investigation, 1915. Recalculated on month-to-month basis.

May[11] estimates from four years' review of the Kentucky Experiment Station herd that the average monthly shrinkage in milk yield during the first eight months of a lactation is 8.1 per cent. Sturtevant[12] found a natural falling-off for each month of 9 per cent of the milk yield compared with the preceding month. Linfield[13] observed a quite constant decrease of about 9 per cent per month until the end of the period.

Tabulating the data we have gathered in our present study with twenty-four cows we find a different shrinkage per cent during the year the cows were bred early, as compared with the

[11] Ky. Agric'l Exp. Station, Bul. 106, p. 55, 1903.
[12] Geneva Exp. Station, Report 1886.
[13] Utah Agric'l Exp. Station, Bul. 68.

year they were left open, or unbred, for several months after calving. The figures in table III show the average decrease each month, expressed as percentage of the production for the preceding month.

TABLE III.

Decrease in Milk Flow of 24 Cows Bred Early in Lactation One Year and Later Another Year.

Month of Lactation	Bred Early	Bred Late
Second	3.0	2.8
Third	5.3	9.0
Fourth	5.4	5.0
Fifth	7.3	4.2
Sixth	6.0	6.7
Seventh	9.4	3.8
Eighth	11.2	5.7
Ninth	14.2	7.2
Tenth	29.3	8.7
Eleventh	44.1	12.0
Twelfth	.....	17.0
Thirteenth	.....	28.3
Fourteenth	.....	37.1

These figures show that the milk flow of the cows bred early in the lactation (about the 80th day after calving) began to shrink greatly the seventh month of lactation, whereas the year they were not bred until later (about 215th day after calving) the shrinkage was not so great until the tenth month of lactation.

2. Influence of Early and Late Abortions on Milk Production

Every dairyman has noted that as the time for calving approaches the udder of the cow becomes greatly enlarged and tense, indicating that the cow is getting ready for heavy milk production. If abortion happens early, before the enlargement of the udder, the cow will not produce her full quota of milk. To determine from actual figures what milk yield may be expected from a cow if the birth of the foetus occurs before the normal

period of 280 days, records of six cows that aborted in approximately 152 days, of six others that aborted in 239 days and of six that calved normally are compared in this study. The first group aborted in 103 to 183 days, an average of 152 days; the second group aborted in 216 to 254 days, an average of 239 days, and the third group carried their calves the full period of 280 days.

The records have been tabulated so that they cover 7 months before the month of abortion or calving and extend eight months after the abortion or calving, counting month of abortion as one of the eight, covering a total milking time of 15 months.

The following table and graph present the results of the study:

TABLE IV.

Milk Yielded from Six Cows Aborting in Five Months. Pounds Per Month.

	8th	7th	6th	5th	4th	3rd	2nd	1st	2nd	3rd	4th	5th	6th	7th	8th
1.	774	719	666	530	552	540	578	603	615	482	488	441	392	407	368
2.	799	656	725	746	703	566	530	450	399	432	392	335	378	372	134
3.	699	578	583	499	575	606	643	554	560	556	572	530	518	509	467
4.	548	521	476	417	378	329	274	309	559	585	597	568	478	403	348
5.	1076	1039	1016	916	757	602	637	451	503	490	535	532	531	483	419
6.	480	465	536	520	527	516	435	467	508	484	538	533	472	432	440
Av.	729	663	667	604	582	527	516	472	524	505	520	490	462	434	363

The above cows carried their calves the following number of days: 1—133, 2—156, 3—161, 4—183, 5—179, 6—131.

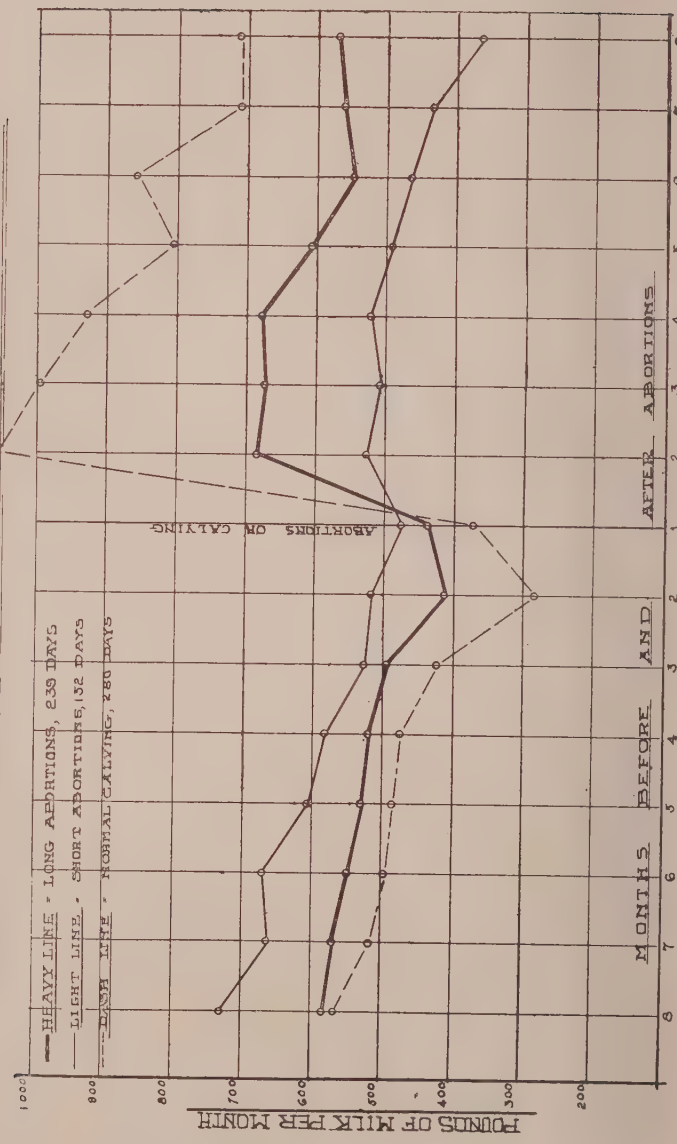
Milk Yielded from Six Cows Aborting in Eight Months. Pounds Per month.

	8th	7th	6th	5th	4th	3rd	2nd	1st	2nd	3rd	4th	5th	6th	7th	8th
1.	518	509	467	429	546	631	532	439	715	718	776	682	517	610	576
2.	644	635	643	579	559	480	416	310	449	445	458	400	477	502	497
3.	664	621	585	576	559	546	572	546	729	915	877	835	743	699	642
4.	629	648	659	665	579	551	360	394	669	576	572	508	496	594	694
5.	556	606	598	639	573	497	502	671	641	607	625	544	480	492	561
6.	476	394	345	288	294	253	84	230	896	771	744	666	562	445	431
Av.	581	568	550	529	518	493	411	432	683	672	675	606	546	557	567

The above cows carried their calves the following number of days: 1—254, 2—251, 3—216, 4—230, 5—229, 6—253.

Milk Yielded from Six Cows Calving Normally. Pounds Per Month.

	8th	7th	6th	5th	4th	3rd	2nd	1st	2nd	3rd	4th	5th	6th	7th	8th
1.	786	725	651	526	564	496	355	480	1040	1073	977	813	715	716	780
2.	512	397	411	407	296	377	512	569	1353	1203	1032	778	713	631	616
3.	496	464	443	501	508	390	163	291	953	846	857	755	715	611	565
4.	411	374	371	372	359	303	146	302	1167	1126	1178	922	1030	994	994
5.	615	539	486	479	563	465	220	174	838	985	915	967	874	784	588
6.	590	599	616	634	575	514	292	407	964	728	615	573	487	523	509
Av.	568	517	496	486	476	424	281	370	1052	993	929	801	756	709	709


STUDY OF ABORTION IN STIMULATING MILK YIELD OF COWS
HEAVY LINE - LONG ABORTIONS, 238 DAYS
LIGHT LINE - SHORT ABORTIONS, 132 DAYS
DASH LINE - NORMAL CALVING, 280 DAYS
ABORTIONS OR CALVING
POUNDS OF MILK PER MONTH
1000
900
800
700
600
500
400
300
200
MONTHS BEFORE AND AFTER ABORTIONS
8 7 6 5 4 3 2 1 2 3 4 5 6 7 8

It will be noted that the three groups of cows were declining in milk production normally until they aborted or calved. The six cows that had been pregnant for an average of 152 days increased very slightly in milk production after the abortion, for they averaged 516 pounds of milk each during the month preceding the abortion and 524 pounds of milk the month after abortion; the cows that aborted after being pregnant for an average of 239 days considerably increased in milk flow after the abortion, averaging 411 pounds of milk the month preceding the abortion and 683 pounds of milk the month succeeding abortion; normal calving of the third group of six cows caused them to rise in milk yield from 281 pounds of milk to 1,052 pounds of milk in a month.

From these results we find that an early abortion, 152 days, will slightly stimulate the milk flow, while a late abortion, 239 days, augments it considerably, but that in neither case are the cows stimulated like the ones that calve normally.

3. Influence of Abortion of First Calves on Milk Production

As stated above, normal calving brings about the proper enlargement and stimulation of the milk glands of the cow. Every one is acquainted with the tense udder and stretched teats of the cow that is due to calve. Our experience has shown that if the heifer fails to conceive at the proper time she will continue to grow in body but her udder will not keep pace in the proper relation and she will never have the productive mammary system of her sister who calved at the normal time. It is known to all dairymen that heifers that abort their calves will produce some milk, the later they abort the better it is, and we desired to obtain some definite figures on the comparative yield that might be expected from good heifers that aborted the first calf, in comparison with good heifers that were more fortunate in carrying their calves the full period of 280 days. The heifers in each group were good and equal in quality, but not the best heifers in the herd.

We have been able to tabulate records of five heifers that aborted their first calves late in their pregnancy, or in 215 to 261 days, and to compare their milk yield for ten months with that of five heifers that calved normally. All were well-grown heifers that averaged 790 pounds in weight at calving time.

The following table shows length of pregnancy of each of the aborting heifers and the pounds of milk that each heifer produced for ten months after aborting, compared with the production of the heifers that calved normally.

TABLE V.

Milk Production of the Five Aborting Heifers in Pounds Each Month.

		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total Milk
1.	215 days	405	754	695	628	572	449	464	460	466	421	5314
2.	225 days	571	592	492	462	384	371	369	341	372	421	4375
3.	240 days	215	451	313	333	434	415	404	416	476	444	3901
4.	255 days	877	778	808	770	680	693	690	651	630	578	7145
5.	261 days	631	618	594	596	422	492	389	423	386	443	4994
Av.	239 days	539	638	580	558	498	484	463	458	466	461	5146

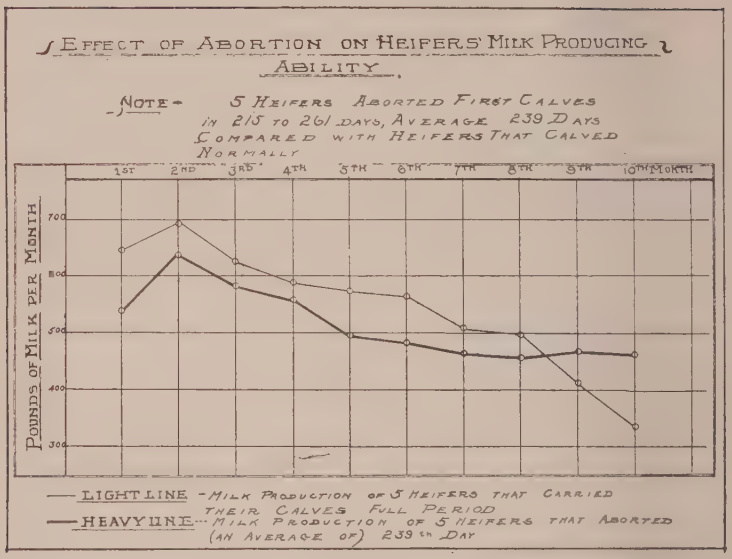
2, 3, 5 Jerseys; 1 and 4 Holsteins.

Milk Production of the Five Heifers Calving Normally.

		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total Milk.
1.	Calved normally	585	832	793	738	682	616	562	462	358	202	5830
2.	Calved normally	507	581	517	478	430	429	350	391	375	276	4334
3.	Calved normally	566	496	439	437	482	483	500	481	405	347	4636
4.	Calved normally	700	798	788	686	655	644	557	643	627	418	6516
5.	Calved normally	869	750	590	599	616	634	575	514	292	407	5846
Av.	Calved normally	645	691	625	588	573	561	509	498	411	335	5432

1, 2, 3, 4 Jerseys; 5 Guernsey.

NOTE:—An additional Jersey heifer that had aborted in 251 days has finished a 12 months' lactation period with a production of 4,200 pounds of milk. Completed since data above were tabulated.


Effect of Abortion on Heifers' Milk Producing Ability.
Note— 5 Heifers Aborted First Calves in 215 to 261 Days, Average 239 Days Compared with Heifers That Calved Normally
1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th Month
Pounds of Milk per Month
700
600
500
400
300
LIGHT LINE - Milk Production of 5 Heifers that Carried their Calves Full Period
HEAVY LINE - Milk Production of 5 Heifers that Aborted (an Average of) 239th Day

From the table and graph it is noted that the heifers that aborted in 7 to 8½ months produced in ten months of their lactation 5,146 pounds of milk, while the heifers that calved normally produced 5,432 pounds of milk in the same length of time. The period of 10 months is used because some of the heifers were dried off at that time. All the heifers that aborted did so easily without any unfortunate after effects. It is realized that if they had aborted earlier in their pregnancy or had become sick after abortion, such high milk yields could not have been expected.

From the table and graph we note that the heifers that calved normally declined rapidly in milk yield after the eighth month of lactation, due to the fact that they were bred during the first month of lactation and were carrying larger foetuses than the aborting heifers that were bred approximately on the 101st day after aborting. Here again, as in our first study, we meet the fact that the larger foetus at five to six months old apparently causes a decided shrinkage in milk yield of the pregnant cows.

4. Influence of Season of the Year on the Quantity and Quality of Milk Produced.

In preparing this study the records of 88 cows have been selected from official test records made during the past two years on two hundred and eighty-four Kentucky Jersey cows. This many records were found sufficiently complete for a full and satisfactory lactation period, to justify their use. Records have been selected for groups of cows that freshened in all seasons of the year, some in winter, spring, summer and fall. The records are based on test periods covering two days each month, during which periods a tester from the Experiment Station visited each herd and weighed the milk from each cow and tested it for fat percentage. The two-day record thus secured is a true index of the productive capacity of the cow for a month, as numerous investigations, particularly in connection with cow test associations, have shown that the multiplication of such figures by the factor 15 gives 30 days' production with an assurance of accuracy of 96 per cent, compared with data gathered by weighing and testing the milk every day of the month.

It has been stated[14] that the tendency is for cows to produce richer milk in winter and poorer milk in summer. As stated, the work reported upon herein embraces records of 88 cows, covering from 10 to 12 months of the lactation period of each cow. Some of the cows were dried off upon completing a ten months' test. The records include twenty-two cows freshening in winter, twenty-three in the spring, twenty in the summer and twenty-three freshening in the fall; thus an almost equal number of records are gathered for cows calving in the four seasons of the year. We believe this is the proper way to determine the seasonal effect on test cows in Kentucky, which may be different from that observed in other sections of the United States.

The tabulated data for the 88 cows are as follows:

[14] Vt. Rpt. 1907, Mo. Bul 179; Conn. Bul. 94; Henry & Morrison's Feeds and Feeding, p. 353; Tenn. Honor Cow List, June, 1923.

TABLE VI.

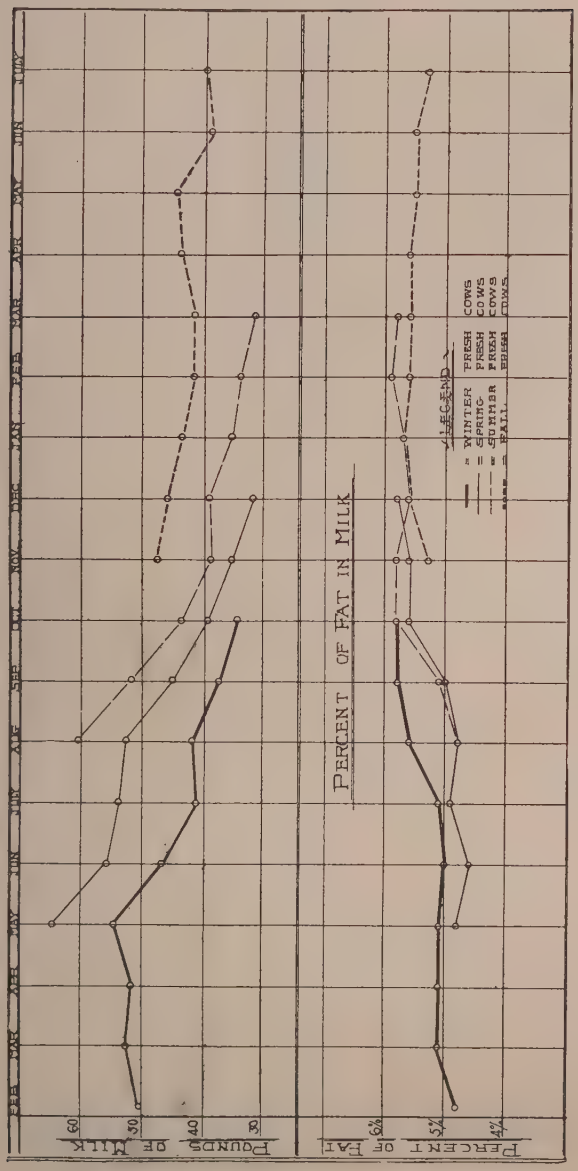
Average Yield of Milk and Percentage of Fat for Cows Freshening at Different Seasons. Two Days' Yield.

Winter Fresh Cows	Dec.		Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.	
	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat
6 cows fresh in December	47.6	4.8	47.9	5.0	44.0	5.2	46.5	5.2	45.4	5.1	50.1	5.1	41.6	4.9	33.1	5.5	34.8	6.6	35.6	5.3	34.9	5.5		
9 cows fresh in January			49.4	5.5	51.5	4.8	51.3	4.9	52.0	4.9	51.7	5.0	44.1	4.0	42.7	5.4	40.6	5.2	34.5	5.4	31.4	5.8		
7 cows fresh in February					55.8	4.8	60.0	5.3	57.9	5.1	62.3	5.2	54.6	5.9	47.4	4.8	50.5	5.1	41.7	6.5	35.9	6.1	30.6	6.4
22 cows average					50.4	4.9	52.6	5.1	51.8	5.1	54.7	5.1	46.8	5.0	41.1	5.1	41.9	5.6	37.3	5.8	34.1	5.8		

Spring Fresh Cows	Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.	
	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat
8 cows fresh in March	63.7	4.7	66.9	4.6	65.3	4.8	56.8	4.5	54.8	4.9	52.5	4.8	42.6	5.0	39.8	5.7	36.5	5.4	33.3	5.7		
4 cows fresh in April			57.7	4.9	63.7	4.5	54.5	4.9	54.0	4.6	54.5	4.7	46.5	4.9	38.9	5.6	33.9	6.0	31.2	5.9		
11 cows fresh in May					64.5	4.9	56.1	4.8	52.6	4.9	51.2	4.8	46.0	4.9	38.5	5.5	35.4	5.5	31.4	5.7	29.5	5.6
23 cows average					64.5	4.7	55.8	4.7	53.8	4.8	52.7	4.8	45.0	4.9	39.1	5.6	35.3	5.6	31.9	5.8		

Summer Fresh Cows	June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.	
	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat
6 cows fresh in June	63.5	4.6	61.0	4.7	63.2	4.5	55.4	4.9	47.1	5.5	40.4	5.8	42.7	5.5	35.7	5.5	32.8	5.8	30.6	5.6		
8 cows fresh in July			51.7	5.2	58.2	4.4	48.3	5.2	42.5	5.8	37.6	5.7	35.8	5.9	34.2	6.1	33.0	6.1	31.9	6.0		
6 cows fresh in August					59.7	4.7	51.2	5.1	40.8	6.1	38.2	6.0	38.1	5.8	35.8	5.6	35.7	5.7	34.3	5.8	35.4	5.7
20 cows average					60.4	4.5	51.6	5.1	43.5	5.8	38.7	5.8	38.9	5.7	35.2	5.7	33.8	5.9	32.3	5.8		

Fall Fresh Cows	Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.	
	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat	Lbs. Milk	% Fat
4 cows fresh in September	49.2	4.9	44.2	6.0	39.8	5.9	37.7	6.3	34.9	6.6	34.4	6.4	32.8	6.3	35.8	6.2	37.2	5.8	29.9	6.1				
7 cows fresh in October			54.1	5.5	55.0	5.3	53.5	5.7	51.0	5.6	46.4	5.5	48.3	5.5	53.8	5.3	52.6	5.6	46.9	5.2	42.2	5.4		
12 cows fresh in November					47.7	4.8	46.3	4.9	43.9	5.2	44.0	5.1	42.4	5.1	41.1	5.4	42.5	5.5	39.4	5.1	37.4	5.1	35.6	5.7
23 cows average					47.5	5.3	45.8	5.6	43.3	5.7	41.6	5.6	41.2	5.6	42.6	5.6	44.1	5.6	39.2	5.4	39.0	5.3		


Graph Shows Milk Yield Two Days Each Month
Pounds of Milk
60
50
40
30
Percent of Fat
6%
5%
4%
Percent of Fat in Milk
Legend
= Winter Fresh Cows
= Spring Fresh Cows
= Summer Fresh Cows
= Fall Fresh Cows
FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL

REVIEW OF DATA

(1) The winter fresh cows produced an average of 50.4 pounds of milk in the two-day test period in February; 52.6 pounds in March; 51.8 pounds in April; 54.7 pounds in May, and 46.8 pounds in June. They increased 4 pounds in milk yield while on spring grass, as was anticipated. They declined slowly but gradually in milk production all summer and fall. The butter fat percentage of their milk was 4.9 per cent in February; 5.1 per cent in March; 5.1 per cent in April; 5.1 in May; 5.0 in June, and 5.1 in July, and after that rose gradually until it reached 5.8 per cent in September. These winter fresh cows gradually rose in milk production from the start in the winter until May and declined gradually thru the summer and fall; while the butter fat content of their milk remained constant at 5.1 per cent until August and rose gradually to 5.8 in October. It is generally thought that cows fresh in winter should greatly increase in milk yield in the spring and early summer, and that the milk will be less rich in the spring. These cows did rise 3 pounds in milk production in May compared with April, but the butter fat test was not lowered in the summer compared with the spring.

(2) The spring fresh cows, numbering 23 head, started off with the highest milk yield of any group, due to the stimulus of calving and the stimulus of green grass, the two stimuli acting simultaneously in this case. But as grass pasture became less abundant in the late summer, a rapid decrease in milk yield is noted, the cows yielding 64.5 pounds milk in the two days in May and only 45 pounds in September, and 32 pounds in December. The fat percentage of the spring fresh group of 23 test cows, rises gradually from May until September and then rises rapidly until the cows are dry in mid-winter. In May the test was 4.8 per cent, in September 4.9 per cent, and in December 5.8 per cent.

(3) The 20 summer fresh cows behave about the same as the spring fresh ones, declining gradually in milk yield from

August when they started with a two day production of 60.4 pounds milk, to 38.7 pounds milk in November, and 32.3 pounds in March. They declined from August to March.

The fat percentage of this group rises rapidly from the start in August, when it registered 4.5 per cent, thru fall to October, when it stood at 5.8 per cent, and it maintained this high level thru the fall and winter.

(4) The 23 fall fresh cows maintained a more level production than any other group. They started in November with 47.5 pounds in the two-day test period, dropped only four to six pounds in January, February and March, and rose a little (to 44.1 pounds) in April and May, and during June and July dropped gradually in milk yield. In fat test, we find that these cows started high, at 5.3 per cent, in November and the test had risen to 5.7 per cent by January, where it stood thru the winter, spring and summer, with little variation.

REVIEWING TABLE AND GRAPH AS A WHOLE.

In reviewing the table and graph as a whole, it is found that the spring grass of May caused a rise in milk yield of the winter and fall fresh cows, but that they declined in a regular way thereafter.

Studying the fat percentage of the milk we find that the percentage runs low in spring in the case of the winter and spring fresh cows, but that the summer and fall fresh cows produce rich milk in spring. In other words, the fat percentage runs lower while the cow is fresh (regardless of the time of year she freshens) and the milk becomes richer as the lactation proceeds, unless some other factor upsets this routine. For instance, the fat percentage of milk of fall fresh cows remains even, or level, because the green grass of spring stimulates milk flow toward the end of their lactation. This results in holding up the milk flow and in holding down the fat percentage. There is no indication that the fat percentage runs lower in July.

As has been observed before, the spring fresh cows start out with a remarkably high production of milk in May and the fat

test is lower than the average until September, as observed in the table and graph.

McDowell,[15] studying records of 10,870 cows in 64 cow-testing associations, finds that fall and winter fresh cows exceed spring and summer fresh cows by 10% in milk and fat production in the course of a year.

To study this matter somewhat in detail we have totalled the amounts of milk and fat given on the bottom line of figures for each group in Table VI. For instance, we have added together the average milk production for each cow included in the winter fresh cows, beginning with 50.4 pounds milk and ending with 34.1 pounds milk produced by each cow in October, and find that the average winter fresh cow produced during the nine months 410.7 pounds milk, while the spring fresh cows averaged 378.1 pounds, the summer fresh 334.4, and the fall fresh 385.6. The fat produced, on the average, was 21.5 pounds for the winter fresh cows, 19.00 pounds for the spring fresh cows, 18.21 pounds for the summer fresh ones and 21.3 pounds for the fall fresh cows.

Tabulated, these data are as follows:

TABLE VII.

No. Cows	Fresh	Period Milked	Yield During Tests		Per Cent	
			Milk	Fat	Milk Lbs.	Fat Lbs.
22	Winter	Feb. to Oct.	410.7	21.50	100	100
23	Spring	May to Dec.	378.1	19.00	92	88
20	Summer	Aug. to Mar.	334.4	18.21	81	85
23	Fall	Nov. to July	385.6	21.34	94	99

From the grand total of all tests, from which Table VI is compiled, we find that the winter fresh cows had longer lactations, and from Table VII we note that the winter fresh cows produced more milk and fat than the cows that freshened in the spring, summer or fall.

These test cows were fed somewhat better and their production is more uniform over the year than many of our cows, but the way they behave over the period of the year reflects the way

[15] U. S. Dept. Agricultural Dept. Bul. 1071.

in which the cows of the better dairymen of Kentucky produce, for most of these cows were owned by farmers who give but little extra care to their test cows. Spring fresh cows that are neglected (or given bad care and feed) suffer for lack of feed in the late summer and fall, and are in many cases dry by fall. The cows reported upon herein were fed and milked twice a day and in some few cases three times daily.

Seasonal Effect on Production.

A large proportion of Kentucky dairy cows calve in the spring and summer. In looking over the 284 test records of Jersey cows owned by Kentucky farmers and breeders, we find that 84 of the cows calved in the spring, 82 in summer, 58 in fall and 60 in winter. The percentage is as follows: 30 per cent calved in spring, 29 per cent in summer; 20 per cent in fall and 21 per cent in winter.

Considering the fact that the spring and summer fresh cows are drying off in the winter when milk and cream are highest in price, and the further fact that it is found from table VI that the fall and winter fresh cows produce more milk and cream during their lactation periods and that they have longer lactations than the spring and summer fresh cows, it is unfortunate that so many of our cows freshen during the latter named months.